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(54) Title: APPARATUS AND METHOD FOR CHARACTERIZING A SAMPLE BY AN OPTICAL PULSE

(57) Abstract: An apparatus for characterising a sample, such as a flow cytometer or a microscope, comprises a laser, in particular a laser configured to emit solitons, for irradiating the sample with an optical pulse and an optical detector for detecting fluorescence radiation emitted by the sample as a consequence of said irradiation. The sample is excited by multiphoton excitation or a non-linear optical device is inserted between the laser and the sample for frequency conversion, thereby obviating the use of a UV laser. The apparatus optionally comprises pulse shaping elements like a pulse stretcher, a pulse amplifier, and a pulse compressor. Light transmission between the laser and the sample may be via optical fibres, in particular optical telecommunication fibres, wherein the light pulse may be distributed to a plurality of measurement heads by means of one or more optical multiplexers.



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INTERNATIONAL SEARCH REPORT

PCT/GB 03/02692

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01N21/64 G01N15/14 G02B21/06 C12N5/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01N G02B C12N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/05858 A (GEN HOSPITAL CORP ;RABITO CARLOS (US)) 24 January 2002 (2002-01-24) * page 22, line 7 - page 24, line 11; figure 3 *	1
X	DE 100 38 080 A (GIESING MICHAEL ;SL MICROTEST WISSENSCHAFTLICHE (DE)) 21 February 2002 (2002-02-21) * paragraphs [0036]-[0040]	1,2

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier document but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
 "&" document member of the same patent family

Date of the actual completion of the international search

20 October 2003

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

PCT/GB 03/02692

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
Claim numbers 1 and 2 are duplicated. The second occurrence of claim 1 was renumbered claim 100. The second occurrence of claim 2 was renumbered claim 101.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1,2

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1,2

Apparatus for characterising optical emission of a sample excited by a laser pulse, said apparatus being configured for confocal illumination and detection.

2. claims: 3-10,49-51,59,60,61(part)

Apparatus for characterising optical emission of a sample excited by a laser pulse (specification of different types of suitable lasers).

3. claims: 11-31,58

Apparatus for characterising optical emission of a sample excited by a laser pulse comprising a non-linear device for frequency conversion of the laser light.

4. claims: 32-42

Apparatus for characterising optical emission of a sample excited by a laser pulse comprising various pulse shaping means.

5. claims: 43-48,52-57,61(part)

Apparatus for characterising optical emission of a sample excited by a laser pulse wherein laser and/or optical detector are provided in various spatial configurations with respect to the sample/samples.

6. claims: 62-77,79-94,96

Apparatus and method for characterising optical emission of a sample excited by multiphoton excitation.

7. claims: 78,97-99

Sperm sexing apparatus and method using an apparatus for characterising an optical emission of a sample excited with a laser pulse.

8. claim: 95

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Method for analysing samples comprising generating solitons,
stretching solitons and amplifying the stretched solitons.

9. claims: 100,101

Flow cytometer/microscope comprising an apparatus for
characterising an optical emission of a sample excited with
a laser pulse.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box 3.

Claim numbers 1 and 2 are duplicated. The second occurrence of claim 1 was renumbered claim 100. The second occurrence of claim 2 was renumbered claim 101.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			AU	8064701 A	30-01-2002
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